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**FULL TEXT OF CASES (USPQ FIRST SERIES)**  
In re Angstadt and Griffin, 190 USPQ 214 (CCPA 1976)

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## **In re Angstadt and Griffin**

**(CCPA)**  
**190 USPQ 214**

**Decided June 24, 1976**  
**No. 75-560**

**U.S. Court of Customs and Patent Appeals**

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### **Headnotes**

#### **PATENTS**

##### **1. Claims — Specification must support (§ 20.85)**

##### **Specification — Sufficiency of disclosure (§ 62.7)**

Court of Customs and Patent Appeals analyzes claims rejected under 35 U.S.C. 112, first and second paragraphs in light of In re Moore, 169 USPQ 236; analysis in this regard should begin with determination of whether claims satisfy requirements of second paragraph; while it may appear awkward to consider two paragraphs in inverse order, when first paragraph speaks of "invention," it can only be referring to invention that applicant wishes to have protected by patent grant, i.e., claimed invention, so that claims must be analyzed first in order to determine exactly what subject matter they encompass; subject matter set out must be presumed, in absence of evidence to contrary, to be that which applicant regards as his invention; first inquiry, therefore, is merely to determine whether claims do, in fact, set out and circumscribe particular area with reasonable degree of precision and particularity; it is here where definiteness of language employed must be analyzed, not in vacuum, but always in light of teachings of prior art and particular application disclosure as it would be interpreted by one possessing ordinary level of skill in pertinent art.

##### **2. Claims — Functional — In general (§ 20.451)**

## **Construction of specification and claims — In general (§ 22.01)**

Effect must be given to all claim limitations; use of functional language is sanctioned specifically by 35 U.S.C. 112, third paragraph.

### **3. Claims — Specification must support (§ 20.85)**

#### **Specification — Sufficiency of disclosure (§ 62.7)**

Whether claims read on subject matter as to which specification is not enabling is Section 112, first paragraph issue.

### **4. Claims — Specification must support (§ 20.85)**

#### **Specification — Sufficiency of disclosure (§ 62.7)**

Once having determined that subject matter defined by claims is particular and definite, analysis turns from 35 U.S.C. 112, second paragraph to Section 112, first paragraph to determine whether scope of protection sought is supported and justified by specification disclosure; inquiries include determining whether subject matter defined in claims is described in specification, whether specification disclosure as whole is such as to enable one skilled in art to make and use claimed invention, and whether best mode contemplated by inventor for carrying out invention is set forth; description of invention and best mode requirements, are relatively simple to comply with and ordinarily demand minimal concern on part of Patent Office; of maximum concern in analysis of whether particular claim is supported by disclosure in application is whether disclosure contains sufficient teaching regarding subject matter of claims as to enable one skilled in pertinent art to make and use claimed invention; relevant inquiry may be summed up as being whether scope of enablement provided to one of ordinary skill in art by disclosure is such as to be commensurate with scope of protection sought by claims.

### **5. Specification — Sufficiency of disclosure (§ 62.7)**

Many chemical processes, and catalytic processes, particularly, are unpredictable and scope of enablement varies inversely with degree of unpredictability involved.

### **6. Specification — Sufficiency of disclosure (§ 62.7)**

Although applicants are not required to disclose every species encompassed by their claims, even in unpredictable art, each case must be determined on its own facts in determining adequacy of Section 112 disclosure.

## **7. Patent grant — Intent of patent laws (§ 50.15)**

### **Specification — Sufficiency of disclosure (§ 62.7)**

View that In re Rainer, 153 USPQ 802, stands for proposition that disclosure must provide guidance that will enable one skilled in art to determine with reasonable certainty before performing reaction, whether claimed product will be obtained, would render all "experimentation" "undue," since "experimentation" implies that success of particular activity is uncertain, and would be contrary to basic policy of Patent Act, which is to encourage disclosure of inventions so as to promote progress in useful arts; to require disclosures in patent applications to transcend level of knowledge of those skilled in art would stifle disclosure of inventions in fields man understands imperfectly, like catalytic chemistry.

## **8. Pleading and practice in Patent Office — Rejections (§ 54.7)**

### **Specification — Sufficiency of disclosure (§ 62.7)**

Patent and Trademark Office has burden of giving reasons, supported by record as whole, why specification is not enabling; showing that disclosure entails "undue" experimentation is part of Patent and Trademark Office's initial burden under In re Armbruster, 185 USPQ 152; Court of Customs and Patent Appeals has never held that evidence of necessity for any experimentation, however slight, is sufficient to require applicant to prove that type and amount of experimentation needed is not "undue."

## **9. Pleading and practice in Patent Office — Evidence (§ 54.5)**

### **Specification — Sufficiency of disclosure (§ 62.7)**

Evidence as whole including inoperative as well as operative examples negate Patent and Trademark Office's position that persons of ordinary skill in unpredictable art must engage in "undue" experimentation to determine which complexes work.

### **Particular patents — Organometallic Complexes**

Angstadt and Griffin, application, Organometallic Complexes as Alkylaromatic Oxidation Catalysts, rejection of claims 3-5, 12-22, and 27 reversed.

### **Case History and Disposition:**

Appeal from Patent and Trademark Office Board of Appeals.

Application for patent of Howard P. Angstadt and William P. Griffin, Jr., Serial No. 772,421, filed Oct. 31, 1968. From decision rejecting claims 3-5, 12-22, and 27, applicants appeal. Reversed; Miller, Judge, dissenting with opinion.

**Attorneys:**

Stanford M. Back, Wayne, Pa., and Donald R. Johnson, St. Davids, Pa., for appellants.

Joseph F. Nakamura (Henry W. Tarring, II, of counsel) for Commissioner of Patents and Trademarks.

**Judge:**

Before Markey, Chief Judge, and Rich, Baldwin, Lane, and Miller, Associate Judges.

**Opinion Text**

**Opinion By:**

Baldwin, Judge.

This appeal is from the decision of the Patent and Trademark Office Board of Appeals affirming the rejection of claims 3-5, 12-22, and 27 in application serial No. 772,421, filed October 31, 1968, for "Organometallic Complexes As Alkylaromatic Oxidation Catalysts." We reverse.

**The Invention**

The claimed invention involves a method of catalytically oxidizing secondary or tertiary alkylaromatic hydrocarbons to form a reaction mixture comprising the corresponding hydroperoxides. The method employs as the catalyst an organometallic complex formed between hexaalkylphosphoramides and metal salts, the complex having the formula  $MX_n(HAPA)_m$ , wherein HAPA is a hexaalkylphosphoramide, MX is a metal salt, m is an integer of from 1 to 8, and n is an integer of from 1 to 4.

In summarizing their invention, appellants state in their specification:

It has now been found, in accordance with the present invention, that organometallic complexes formed between metal salts, preferably those derived from transition metals, (including metals of the lanthanide and actinide series), and hexaalkylphosphoramides are effective catalysts in the oxidation of secondary and tertiary alkylaromatic hydrocarbons. Certain of these catalysts, and particularly those derived from metal salts of the lanthanide series, are especially effective in forming the hydroperoxides of the alkylaromtic [sic] hydrocarbons to the exclusion of other hydrocarbon oxidation products, thus providing the hydroperoxides in high yields at increased conversion rates.

The products produce by this process are described in appellants' specification as follows:

[T]he oxidation products of the instant process are generally, alcohols, aldehydes, ketones, hydroperoxides, or mixtures thereof. Of these various products, maximization of the formation of the hydroperoxides is generally preferred \* \* \*. Accordingly, as a preferred embodiment of this invention, it has been discovered that *certain* of the various metals \* \* \* are particularly effective as catalysts in the preparation of hydroperoxides from secondary and tertiary alkylaromatic compounds \* \* \*. These metals preferentially give yields of over 90 percent hydroperoxides to the exclusion of other oxidation products at conversion rates of at least about 4 percent per hour, and in many cases as high as 20 to 25 percent per hour. In the case of those remaining metals which yield lesser amounts or *no hydroperoxides* in the final product, while applicants do not wish to be bound by any particular theory, it is believed that they too yield hydroperoxides which are then rapidly decomposed by the catalyst complex to form aldehydes, ketones and the like. [Emphasis added.]

Claims 22 and 27 are illustrative and read as follows:

22. The process according to Claim 27 wherein the oxidation is carried out in the added presence of a hydroperoxide.

27. In the process for the catalytic oxidation of secondary or tertiary alkylaromatic hydrocarbons of the formula

*Graphic material consisting of a chemical formula or diagram set at this point is not available. See text in hard copy or call BNA PLUS at 1-800-452-7773 or 202-452-4323.*

wherein R is lower alkyl; R<sub>1</sub> is lower alkyl or hydrogen; and Ar is an aromatic nucleus selected from the group consisting of phenyl and naphthyl, in the presence of air or oxygen at a temperature of from about 80 to 150°C to form a reaction mixture comprising the corresponding hydroperoxides, the improvement wherein the catalyst is of the formula

MX<sub>n</sub>(HAPA)<sub>m</sub>

wherein HAPA is a hexaalkylphosphoramidate, the alkyl moiety of which has from one to thirty carbon atoms; MX is metal salt wherein M is a transition metal cation of Group IB, IIB, IIIB, IVB, VB, VIB, VIIB, VIIIB or IIA of the Periodic Table and X is an inorganic anion of said metal salt; m is an integer of from 1 to 8; and n is an integer of from 1 to 4, wherein the ratio of said catalyst to said alkylaromatic hydrocarbon is from about 0.1 to 5.0 parts by weight of catalyst per 100 parts by weight of alkylaromatic hydrocarbon.

### The Rejection

The examiner rejected all of the claims under 35 USC 112, first and second paragraphs. However, the board's rationale for affirming the rejection was directed primarily to the enablement requirement of the first paragraph of section 112. The board considered the question of "whether the claims on appeal read on subject matter as to which the specification is not enabling." The claims and the specification were compared and it was found:

[T]he claims call for the preparation of a reaction mixture comprising the hydroperoxides, using the metal salt complexes as the catalyst. However, the specification states that not all of the complexes will produce hydroperoxides and neither discloses which of the complexes will *not* work nor gives any information as to how the operative catalysts might be determined, without *undue* experimentation. We believe that the specification leaves too much to conjecture, speculation and experimentation and is insufficient in law to support the present claims containing the disputed language. [Emphasis in original.]

In addition, the board specifically pointed to claim 22 as being "inconsistent with claim 27 in light of present Example 6,

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which indicates that the presence of added hydroperoxide results in a product devoid of the recited 'corresponding hydroperoxides.'" The board went on to state that "insofar as this is a further ground of rejection under 35 USC 112, it is sustained."

### Opinion

[1] Since all of the claims have been rejected under the first and second paragraphs of 35 USC 112, we begin with the analysis set forth in *In re Moore*, 58 CCPA 1042, 1046-47, 439 F.2d 1232, 1235, 169 USPQ 236, 238 (1971):

Any analysis in this regard should begin with the determination of whether the claims satisfy the requirements of the second paragraph. It may appear awkward at first to consider the two paragraphs in inverse order but it should be realized that when the first paragraph speaks of "the invention", it can only be referring to that invention which the applicant wishes to have protected by the patent grant, i.e., the *claimed* invention. For this reason the claims must be analyzed first in order to determine exactly what subject matter they encompass. The subject matter there set out must be presumed, in the absence of evidence to the contrary, to be that "which the applicant regards as his invention."

This first inquiry therefore is merely to determine whether the claims do, in fact, set out and circumscribe a particular area with a reasonable degree of precision and particularity. It is here where the definiteness of the language employed must be analyzed — not in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art. [Footnote omitted, original emphasis.]

[2] We note at the outset that the claim limitation "to form \* \* \* hydroperoxides" must be given effect since we *must* give effect to *all* claim limitations. See *In re Geerdes*, 491 F.2d 1260, 180 USPQ 789 (CCPA 1974); *In re Wilder*, 57 CCPA 1314, 429 F.2d 447, 166 USPQ 545 (1970). Furthermore, the use of functional language is sanctioned specifically by the third paragraph of section 112. Finally, in this particular case, the functional limitation was inserted in the claims at the specific insistence of the examiner.

[3] We further note that, while the board affirmed the examiner's rejection of the claims under both the first and second paragraphs of section 112, it stated that the primary issue is "whether the claims on appeal read on subject matter as to which the specification is not enabling." This is a section 112, first paragraph issue. In *re Geerdes*, *supra*. At any rate, we conclude that the scope of the subject matter embraced by the instant claims is clear and the claims do, in fact, set out and circumscribe a particular area with a reasonable degree of precision and particularity. In *re Moore*, *supra* at 1046-47, 439 F.2d at 1235, 169 USPQ at 238. Therefore, the rejection under the second paragraph of 35 USC 112 is reversed.

[4] Continuing with the analysis described in *Moore*, *supra*:

Once having determined that the subject matter defined by the claims is particular and definite, the analysis then turns to the first paragraph of section 112 to determine whether the scope of protection sought is supported and justified by the specification disclosure. This first paragraph analysis in itself contains several inquiries.

Considering the language of the statute, it should be evident that these inquiries include determining whether the subject matter defined in the claims is described in the specification, whether the specification disclosure as a whole is such as to enable one skilled in the art to make and use the claimed invention, and whether the best mode contemplated by the inventor of carrying out that invention is set forth.

Two of the first paragraph requirements indicated above, i.e., the "description of the invention" and the "best mode" requirements, are relatively simple to comply with and thus will ordinarily demand minimal concern on the part of the Patent Office. \* \*

\* What is of maximum concern in any analysis of whether a particular claim is supported by the disclosure in an application is whether that disclosure contains sufficient teaching regarding the subject matter of the claims as to enable one skilled in the pertinent art to make *and* to use the claimed invention. These two requirements, "how to make" and "how to use" have sometimes been referred to in combination as the "enablement" requirement, but, in one form or another, have been the subject of extended discussion in this court of recent years. The relevant inquiry may be summed up as being whether the scope of enablement provided to one of ordinary skill in the art by the disclosure is such as to be commensurate with the scope of protection sought by the claims.

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[58 CCPA at 1047, 439 F.2d at 1235-36, 169 USPQ at 238-39, original emphasis.]

[5] We cannot agree with the board that appellants' disclosure is not sufficient to enable one of ordinary skill in the art to practice the invention without undue experimentation. We note that many chemical processes, and catalytic processes particularly, are unpredictable. In re Mercier, 515 F.2d 1161, 1167-68, 185 USPQ 774, 779 (CCPA 1975), and that the scope of enablement varies inversely with the degree of unpredictability involved. In re Fisher, 57 CCPA 1099, 1108, 427 F.2d 833, 839, 166 USPQ 18, 24 (1970). That this particular process is unpredictable is demonstrated further by appellants in their specification. Appellants have disclosed forty examples; one of these examples yields no hydroperoxides in the final product. Also, appellants have expressly indicated in their specification that some of these organometallic complex catalysts "yield \* \* \* no hydroperoxides in the final product." <sup>1</sup>

Appellants have apparently not disclosed *every* catalyst which will work; they have apparently not disclosed *every* catalyst which will not work. The question, then, is whether in an unpredictable art, section 112 requires disclosure of a test with *every* species covered by a claim. To require such a complete disclosure would apparently necessitate a patent application or applications with "thousands" <sup>2</sup> of examples or the disclosure of "thousands" of catalysts along with information as to whether each exhibits catalytic behavior resulting in the production of hydroperoxides. More importantly, such a requirement would force an inventor seeking adequate patent protection to carry out a prohibitive number of actual experiments. This would tend to discourage inventors from filing patent applications in an unpredictable area since the patent claims would have to be limited to those embodiments which are expressly disclosed. A potential infringer could readily avoid "literal" infringement of such claims by merely finding another analogous catalyst complex which could be used in "forming hydroperoxides."



[6] Having decided that appellants are *not* required to disclose *every* species encompassed by their claims even in an unpredictable art such as the present record presents, each case must be determined on its own facts. In the instant case, appellants' invention is the use of a complex catalyst comprising a hexaalkylphosphoramidate and a transition metal salt to catalyze the oxidation of secondary or tertiary alkylaromatic hydrocarbons to form hydroperoxides. Appellants have, in effect, provided those skilled in this art with a large but finite list of transition metal salts from which to choose in preparing such a complex catalyst. Appellants have actually carried out 40 runs using various transition metal salts and hexaalkylphosphoramidates. If one skilled in this art wished to make and use a transition metal salt other than those disclosed in appellants' 40 runs, he would merely read appellants' specification for directions how to make and use the catalyst complex to oxidize the alkylaromatic hydrocarbons, and could then determine whether hydroperoxides are, in fact, formed. The process discovered by appellants is not complicated, and there is no indication that special equipment or unusual reaction conditions must be provided when practicing the invention. One skilled in this art would merely have to substitute the correct mass of a transition metal salt for the transition metal salts disclosed in appellants' 40 runs. Thus, we have no basis for concluding that persons skilled in this art, armed with the specification and its 40 working examples, would not easily be able to determine which catalyst complexes within the scope of the claims work to produce hydroperoxides and which do not.

Since appellants have supplied the list of catalysts and have taught how to make and how to use them, we believe that the experimentation required to determine which catalysts will produce hydroperoxides would not be undue and certainly would not "require ingenuity beyond that to be expected of one of ordinary skill in the art." *Fields v. Conover*, 58 CCPA 1366, 1372, 443 F.2d 1386, 1390-91, 170 USPQ 276, 279 (1971).

[7] The dissent's reliance on *In re Rainer*, 54 CCPA 1445, 377 F.2d 1006, 153 USPQ 802 (1967), is misplaced. If *Rainer*

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stands for the proposition that the disclosure must provide "guidance which will enable one skilled in the art to determine, *with reasonable certainty before performing the reaction*, whether the claimed product will be obtained" (emphasis in original), as the dissent claims, then *all* "experimentation" is "undue," since the term "experimentation" implies that the success of the particular activity is *uncertain*. Such a proposition is contrary to the basic policy of the Patent Act, which is to encourage disclosure of inventions and thereby to promote progress in the useful arts. To require disclosures in patent applications to transcend the level of knowledge of those skilled in the art would stifle the disclosure of inventions in fields man understands imperfectly, like catalytic chemistry. The Supreme Court said it aptly in *Minerals Separation, Ltd. v. Hyde*, 242 U.S. 261, 270-71 (1916), in discussing the adequacy of the disclosure of the froth flotation process of ore separation:

Equally untenable is the claim that the patent is invalid for the reason that the evidence shows that when different ores are treated preliminary tests must be made to determine the amount of oil and the extent of agitation necessary in order to obtain the best results. Such variation of treatment must be within the scope of the claims, and *the certainty which the law requires in patents is not greater than is reasonable*, having regard to their subject-matter. The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law. *Mowry v. Whitney*, 14 Wall. 620; *Ives v. Hamilton*, 92 U.S. 426, and *Carnegie Steel Co. v. Cambria Iron Co.*, 185 U.S. 403, 436, 437. [Emphasis added.]

Appellants have broadly disclosed a class of catalyst complexes whose use they deem to be part of their invention. But for this disclosure the public may have been deprived of the knowledge of appellants' process. In this art the performance of trial runs using different catalysts is "reasonable," even if the end result is uncertain, and we see no reason on this record why appellants should not be able to claim as their invention the broad range of processes which they have discovered. The PTO withdrew a rejection of the claims under 35 USC 103, and it appears that persons skilled in this art would know how to perform processes within the scope of the claims, within the ambit of the types and amount of experimentation which the uncertainty of this art makes inevitable.

The kind of "guidance" which the dissent seems to contemplate is unrealistic in view of the nature of the invention. The examples, both operative and inoperative, are the best guidance this art permits, as far as we can conclude from the record.

[8] We note that the PTO has the burden of giving reasons, supported by the record as a whole, why the specification is not enabling. In *re Armbruster*, 512 F.2d 676, 185 USPQ 152 (CCPA 1975). Showing that the disclosure entails *undue* experimentation is part of the PTO's initial burden under *Armbruster*; this court has never held that evidence of the necessity for *any* experimentation, however slight, is sufficient to require the applicant to prove that the type and amount of experimentation needed is *not* undue.

By calling the claimed "invention" the "scope of protection sought" the dissent obscures the problem and frustrates the intended operation of the patent system. Depriving inventors of claims which adequately protect them and limiting them to claims which practically invite appropriation of the invention while avoiding infringement inevitably has the effect of suppressing disclosure. What the dissent seems to be obsessed with is the thought of catalysts which *won't* work to produce the intended result. Appellants have enabled those in the art to see that this is a real possibility, which is commendable frankness in a disclosure. Without undue experimentation or effort or expense the combinations which do not work will readily be discovered and, of course, nobody will use them and the claims do not cover them. The dissent wants appellants to make everything predictable in advance, which is impracticable and unreasonable.

[9] We hold that the evidence *as a whole*, including the inoperative as well as the operative examples, negates the PTO position that persons of ordinary skill in *this* art, given its unpredictability, must engage in *undue* experimentation to determine which complexes work. The key word is "undue," not "experimentation." See *Fields v. Conover*, supra.

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The rejection of claim 22 as being inconsistent with claim 27 in light of Example 6 is also reversed. First, it is not clear on this record whether the examiner actually made a separate rejection of claim 22 on this ground. If the examiner did not make such a rejection, then appellants could not acquiesce in the rejection as the board concluded.

Second, there is no reason to believe that the product recited in Example 6 is, in fact, devoid of hydroperoxides. Run 7 (Table I) and the fourth run in Examples 8 (Table VI) both use the exact same metal salt, albeit a different alkylaromatic hydrocarbon starting material, as in Example 6 and hydroperoxides are produced in both cases. Example 6 merely states that the white solid material produced in the process "was identified as actaldehyde [sic]." Example 6 clearly does not expressly state that no hydroperoxides were produced. Nor does it implicitly so state in view of the well-known fact that products of organic chemical reactions are almost never produced in a 100% yield but are generally contaminated with other side products. We believe that one of those side products may be a hydroperoxide in view of the fact that hydroperoxides were produced in other runs involving the same metal salt catalyst. <sup>3</sup>Appellants may not have believed it necessary to state that hydroperoxides were, in fact, a (minor) product of Example 6 since the claims as originally filed did not require that appellants' process "form hydroperoxides." <sup>4</sup>

Finally, there is no record evidence to establish that the presence of hydroperoxides in Example 6 *results* in a product which is devoid of the recited "corresponding hydroperoxides." Because of this lack of record evidence, we discern no inconsistency between claims 22 and 27 in light of Example 6. Accordingly, the decision of the board is reversed.

### Footnotes

Footnote 1. The unpredictability of appellants' process is also evidenced by the fact that nickel (run 1, Table I), cupric (run 2, Table I), and zinc (run 14, Table I) chloride, as well as silver nitrate (run 8, Table I) are useful (i.e., produce hydroperoxides) in appellants' process whereas cuprous chloride (run 15, Table I) is not. (Nickel and zinc are directly to the left and right respectively of copper in the periodic table: silver is directly below copper in the periodic table.)

Footnote 2. The solicitor, without refutation by appellants, states; "Claim 27 literally reads on thousands of metal salt complexes in which the metal salt moiety may comprise any one of at least 50 metal cations combined with any inorganic anion."

Footnote 3. We note also that Example 4 employs the same reactant (sec-butylnaphthalene) as used in Example 6 but different metal salt catalysts (NdCl 3.HMPA and TiCl 4.HMPA) and hydroperoxides are produced. (HMPA stands for "hexamethylphosphoramide").

Footnote 4. Claim 1, as originally filed, reads as follows:

A process for the oxidation of secondary and tertiary alkylaromatic compounds which comprises contacting said compounds with oxygen at an elevated temperature in the presence of a catalyst comprising a hexaalkylphosphoramidate and a metal salt.

### Dissenting Opinion Text

#### Dissent By:

Miller, Judge, dissenting.

The controlling issue in this case is: Whether the scope of enablement (represented by the processes disclosed in the specification) is commensurate with the scope of protection sought by the claims, which include the limitation "to form a reaction mixture comprising the corresponding hydroperoxides."

Although it is evident that by following some of appellants' examples a reaction mixture will be formed comprising the corresponding hydroperoxides, it does not follow that the scope of enablement is commensurate with the scope of the claims. As this court well said in *In re Rainer*, 52 CCPA 1593, 1597, 347 F.2d 574, 578, 146 USPQ 218, 221 (1965), discussing an inadequate disclosure:

[T]his failure stems not from the absence of working examples but rather from the failure of appellants to disclose any factors which would cause a person of skill in this art to select from the 53 listed materials those which will produce the claimed product.

Indeed, if this court permits, as would the majority, the number of examples to decide the question of enablement, regardless of the breadth of the claims and the amount of experimentation required by the absence of guidance in the disclosure, an applicant for a patent in an unpredictable art can assure success of his application simply by playing the numbers game. The majority has given no reason for ignoring this court's policy that "there is no magical relation between the number of representative examples and the breadth of the claims" with respect to enablement. In re Borkowski, 57 CCPA 946, 952-53, 422 F.2d 904, 910, 164 USPQ 642, 646 (1970).

The later Rainer case (54 CCPA 1445, 377 F.2d 1006, 153 USPQ 802 (1967)), well illustrates appellants' problem here. There the main claim in issue under an inadequate disclosure rejection recited a bottle made of an "irradiated polyethylene \* \* \* having grafted thereto a polymer formed by polymerizing a member of the group" (of selected monomers). The specification recited various suitable monomers. As in the present case, preference was stated for one subgroup. This consisted of hydrocarbon monomers. A second subgroup was also disclosed:

Also, there can be used monomers such as alkyl acrylates and methacrylates \* \* \*, N,N-methylene-bis-acrylamide, polyallyl esters \* \* \* dialkenyl oxalates \* \* \*, triallyl melamine, dialkyl maleates and fumarates \* \* \*.

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The specification included numerous examples of bottles formed by a graft polymerization of polyethylene with various monomers. It also contained an example of a specific monomer from the second subgroup which would not graft polyethylene. No guidance was provided concerning the reactants within the scope of the claim which formed the claimed product. The court's opinion quotes from the Solicitor's explanation of the rationale of the board's rejection:

Essentially, it is based on the fact that, although the present specification catalogs a large number of monomers \* \* \* which can be irradiated with polyethylene to form graft cross-linked copolymers, that catalog of monomers includes ethylene glycol dimethacrylate which further on in the specification \* \* \* is shown *not* to form a graft cross-linked copolymer \* \* \*. Consequently, the Board properly concluded that the disclosure would be considered adequate as to those monomers actually shown by the examples (or otherwise in the original disclosure) to form graft cross-linked copolymers with the polyethylene \* \* \* but inadequate as to any other monomers or the very broad category of "polymerizable ethylenically unsaturated hydrocarbon monomers" \* \* \*

In affirming the board, this court said:

The thrust of the inadequate disclosure rejection is that appellants have claimed more broadly than they have invented. It is maneuvered into the shadow, at least, of section 112 by the observation that the specification gives no indication whether these monomers for which there is no specific example will behave on irradiation like styrene, which forms a graft copolymer, or like ethylene glycol dimethacrylate, which does not.

Here the board has pointed to appellants' own specification, which concedes that some organometallic complex catalysts "yield \* \* \* *no* hydroperoxides in the final product." (Emphasis added.) Moreover, the Solicitor has pointed to examples in appellants' specification where no hydroperoxide was formed in the final product. Thus, in run 15 of Example 2, using  $\text{Cu}_2\text{Cl}_2$  as the metal salt of the organometallic complex catalyst and cumene as the alkylaromatic hydrocarbon, no hydroperoxide was found in the final product. In Example 6, using  $\text{MnCl}_2$  as the metal salt of the organometallic complex catalyst and *sec*-butylnaphthalene as the alkylaromatic hydrocarbon, the final product did not contain hydroperoxide. <sup>1</sup>Since the organometallic complex catalysts and the alkylaromatic hydrocarbons used in these two examples fall within the materials recited in the claims, and since appellants' specification states that some catalysts will not produce hydroperoxide in the final product, <sup>2</sup>the burden of substantiating the doubts of the Patent and Trademark Office concerning the sufficiency of the disclosure has been met. <sup>3</sup>As this court said in the later Rainer case, *supra*, 54 CCPA at 1452, 377 F.2d at 1012, 153 USPQ at 807:

The present case is unusual in that appellants' specification is the evidence of its own inadequacy. The board properly relied upon it.

See also Judge Baldwin's concurring opinion in *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976). Thus, the burden shifted to appellants to show that their teaching of producing hydroperoxides is

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commensurate in scope with the claims. *In re Cook*, 58 CCPA 1049, 439 F.2d 730, 169 USPQ 298 (1971); *In re Marzocchi*, 58 CCPA 1069, 439 F.2d 220, 169 USPQ 367 (1971).

The majority erroneously attempts to meet the "undue experimentation" problem by saying that if one skilled in the art wished to make and use a transition metal salt other than those disclosed in the examples, "he would merely read appellants' specification for directions how to make and use the catalyst complex \* \* \* *and could then determine* [by conventional techniques] *whether hydroperoxides are, in fact, formed.*" (Emphasis added.) This approach violates the logic of the *Rainer* cases that there must be guidance which will enable one skilled in the art to determine, *with reasonable certainty before performing the reaction*, whether the claimed product will be obtained. See *Minerals Separation, Ltd. v. Hyde*, 242 U.S. 261, 270 (1916). The testing advocated by the majority's reference to "experimentation, however slight" simply ignores the breadth of the scope of the claims to *all* reactants and catalysts that produce hydroperoxides. The majority appears to confuse type of testing with degree of testing, and it is the *undue* degree with which we are concerned. The majority appears to suggest that there can be no undue experimentation because of the "amount of experimentation which the uncertainty of this art makes inevitable." However, this court stated in *Fields v. Conover*, 58 CCPA 1366, 1372, 443 F.2d 1386, 1390-91, 170 USPQ 276, 279 (1971):

[A] disclosure complies with the how-to-make requirement of 35 USC 112 even though "some experimentation, provided it is not an undue amount" (and provided it does not require ingenuity beyond that to be expected of one of ordinary skill in the art), is still required. \* \* \*

Although appellants' specification shows some 38 examples (embodiments) within the broad scope of the claims, this number is minute in comparison with the immense number of combinations of organometallic catalysts and alkylaromatic hydrocarbons within that scope. <sup>4</sup>*The specification fails to provide guidance for determining which of the combinations are proper and which are not*. For example, no guidance is shown with respect to the reactants (alkylaromatic hydrocarbons) which should be used with a manganese-containing catalyst to predictably produce hydroperoxide. The specification lists 12 metals as particularly effective in catalysts, but the claims are not limited to these 12. The 53 metals remaining from the broadly recited group are described as those remaining metals which yield lesser amounts or no hydroperoxides in the final product." With respect to the 53, the specification states that the applicants "do not wish to be bound by any particular theory" concerning the yielding of lesser amounts or no hydroperoxides in the final product. Of the 38 examples, 26 involve metals on the list of 12. Of the remaining 53 metals, only 12 are involved in the other 12 examples; and 2 of these are involved in 2 additional examples which were unsuccessful. Thus, we have examples (embodiments) involving only 22 of the 65 metals plus 2 which involve both successful and unsuccessful results. At best, in the case of 43 metals and the thousands of combinations in which they would be included, along with varying reaction conditions, experimentation would be required to determine operability. There is simply no teaching of how to choose those secondary and tertiary alkylaromatic hydrocarbons and organometallic catalysts which will form hydroperoxides. The need for guidance to enable the invention, with its claims to a myriad of combinations of organometallic catalysts and alkylaromatic hydrocarbons, to be practiced without undue experimentation is evident.

This court has stated that in determining whether a specification is "clearly sufficiently definite to guide those skilled in the art" to practice the invention, "nothing must be left to speculation or doubt." *In re Eltgroth*, 57 CCPA 833, 837, 419 F.2d 918, 921, 164 USPQ 221, 223 (1970).

The court has also long recognized that catalytic phenomena and chemical reactions are unpredictable. *In re Mercier*, 515 F.2d 1161, 1167-68, 185 USPQ 774, 779 (CCPA 1975); *In re Marzocchi*, *supra*, 58 CCPA at 1073, 439 F.2d at 223, 169 USPQ at 369-70.<sup>5</sup>

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As stated by the court in *In re Fisher*, 57 CCPA 1099, 1108, 427 F.2d 833, 839, 166 USPQ 18, 24 (1970):

In cases involving predictable factors, such as mechanical or electrical elements, a single embodiment provides broad enablement in the sense that, once imagined, other embodiments can be made without difficulty and their performance characteristics predicted by resort to known scientific laws. In cases involving unpredictable factors, such as most chemical reactions and physiological activity, the scope of enablement obviously varies inversely with the degree of unpredictability of the factors involved.

Obviously this does not mean that the unpredictability of catalysts requires a working example for each embodiment within a claim. *It does mean that appellants' specification must contain guidance for choosing the proper combinations of catalysts and alkylaromatic hydrocarbons.* As the board well said, "the specification leaves too much to conjecture, speculation and experimentation." Thus, if appellants' claims had been limited to the 12 metals referred to above, and the examiner had failed to sufficiently challenge enablement with evidence or reasoning, a working example for each embodiment within the claims would be unnecessary. Moreover, if appellants had broadened their claims so that the *specific oxidation product* was not recited and the examiner had failed to sufficiently challenge appellants' assertion that all of the specified reactants were *oxidized* in the presence of the specified catalysts, a working example for each embodiment within the claims would be unnecessary. Accordingly, the majority's posing of the question whether a working example is required for each embodiment within the claims is merely the use of the "straw man" technique.

Although appellants have claimed an improved method for forming a reaction mixture comprising the corresponding hydroperoxides where the products formed are not part of the invention, enablement for forming such products, even if they are well known, is nonetheless required. See *In re Joliot*, 47 CCPA 722, 727, 270 F.2d 954, 958, 123 USPQ 344, 347 (1959), cert. denied, 362 U.S. 977, 125 USPQ 667 (1960).

In view of the foregoing, it is clear that appellants' specification does not enable one of ordinary skill in the art to practice the invention *as broadly claimed* without undue experimentation. The board properly affirmed the examiner's rejection of all claims under the first paragraph of 35 USC 112.



## Footnotes

Footnote 1. The majority states that "there is no reason to believe that the product recited in Example 6 is, in fact, devoid of hydroperoxides," noting that run 7 and the fourth run in Example 8 "both use the exact same metal salt, albeit a different alkylaromatic hydrocarbon starting material, as in Example 6 and hydroperoxides are produced in both cases" and that "Example 4 employs the same reactant \* \* \* as used in Example 6 but different metal salt catalysts \* \* \* and hydroperoxides are produced." The reason, of course, is that a different reactant or a different metal salt catalyst was used in Example 6. Moreover, appellants in their main brief have not argued that Example 6 produced hydroperoxide and in their reply brief have not controverted the Solicitor's statement in his brief that Example 6 did not produce hydroperoxide.

Footnote 2. Appellants' theory that the hydroperoxide is formed as an intermediate is unresponsive to the clear language of claim 27 that the reaction is to form a "mixture comprising the corresponding hydroperoxides."

Footnote 3. The initial burden of proof was on the Patent and Trademark Office. As we stated in *In re Dinh-Nguyen*, 492 F.2d 856, 858, 181 USPQ 46, 47 (CCPA 1974):

Any assertion by the Patent Office that the enabling disclosure is not commensurate in scope with the protection sought must be supported by evidence or reasoning substantiating the doubts so expressed.

Contrary to the majority opinion, which provides no citation of authority, it was *not* necessary for the Patent and Trademark Office initially to *also* show that undue experimentation is required to substantiate its doubts. See *In re Armbruster*, 512 F.2d 676, 185 USPQ 152 (CCPA 1975).

Footnote 4. The Solicitor, without refutation by appellants, states: "Claim 27 literally reads on thousands of metal salt complexes in which the metal salt moiety may comprise any one of at least 50 metal cations combined with any inorganic anion."

Footnote 5. Appellants' argument that the catalytic oxidation process of hydrocarbons is extremely well known, as are the corresponding products formed, is not supported by evidence; and even if it were, it does not respond to the problem of unpredictability. Argument of counsel cannot take the place of evidence. *In re Schulze*, 52 CCPA 1422, 346 F.2d 600, 145 USPQ 716 (1965); *In re Cole*, 51 CCPA 919, 326 F.2d 769, 140 USPQ 230 (1964).

**- End of Case -**